

The Role of Pain Management in Recovery Following Trauma and Orthopaedic Surgery

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Abstract

War often serves as a catalyst for medical innovation and progressive change. The current conflicts are no exception, particularly in the area of pain management of wounded warriors. Morphine administration has served as the primary method of battlefield pain management since the American Civil War. Although traditional opioid-based pain management is effective, it has significant side effects that can complicate recovery and rehabilitation following injury. These side effects (eg, sedation, nausea and vomiting, ileus, respiratory depression) can be fatal to persons wounded in combat. This fact, along with recent research findings indicating that pain itself may constitute a disease process, points to the need for significant improvements in pain management in order to adequately address current battlefield realities. The US Army Pain Management Task Force evaluated pain medicine practices at 28 military and civilian institutions and provided several recommendations to enhance pain management in wounded warriors.

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Neither Dr. Buckenmaier nor any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article.

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In Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF), the military medical services have achieved an historically low rate of lethality of war wounds (approximately 10%).¹ Factors that contributed to this achievement include advances in body armor, availability of improved surgical and resuscitative care close to battle, the presence of highly trained and capable combat medics, and rapid evacuation to higher levels of care in theater and to sites with surgical facilities.² Although rapid evacuation of persons with traumatic injury from the battlefield using multiple aircraft has enhanced survival, pain management is particularly challenging in this environment when intravenous morphine is the only option.³

There is widespread agreement that investing medical resources in adequate pain management is the only appropriate ethical response to the pain experienced by wounded warriors. A growing body of evidence suggests that poorly managed pain has a negative effect on nearly every aspect of patient recovery and rehabilitation.⁴

Opioid Use and Related Complications

Morphine administration has been the primary method of battlefield analgesia in the US military since the American Civil War.⁵ Despite the life-threatening side effects associated with the use of morphine and

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other opioids in combat casualties, morphine is effective in managing pain following trauma, and it is the standard against which other analgesic medications are compared.^{6,7}

Traditional opioid-based management plans for US service members must be reviewed in light of recent research indicating the phenomenon of opioid-induced hyperalgesia. Opioid therapy, particularly the high-dose therapy that is used on many of those who are severely wounded, may cause heightened pain sensitivity and may aggravate existing pain syndromes.⁸ Additionally, the unwanted side effects associated with opioids (eg, sedation, nausea and vomiting, ileus, respiratory depression) may be exacerbated when opioids are the sole method of pain management. Whereas these consequences are merely difficult to manage in civilian medicine, they are potentially life-threatening in the complex combat evacuation environment. Polytrauma secondary to blast exposure is one of the signature injuries of OIF and OEF. One study indicated that service members with such injury who presented to Veterans' Administration rehabilitation centers demonstrated opioid analgesic use two to four times higher than that of soldiers injured by other means.⁹ The challenges facing our US military personnel from opioid misuse, abuse, and dependence have been well-publicized in the media.¹⁰

Pain Medicine

Woolf¹¹ has suggested that pain can be broadly categorized as either adaptive or maladaptive. Adaptive pain is vital for survival. It warns persons of impending injury and is self-limited. For example, a stubbed toe results in minor but persistent pain that causes the injured person to protect the toe from further in-

jury. In contrast, maladaptive pain occurs when the nervous system is overwhelmed by pain stimulation, resulting in a chronic disease state. One example of maladaptive pain is severe phantom pain that persists for years after wound healing in a person who suffered traumatic foot amputation resulting from a blast injury.

Traditionally, pain has been considered to be a symptom of a disease process or trauma. As a result, attention to the medical management of pain usually was not prioritized because it was felt that correction of the physical abnormality that caused the pain would result in alleviation of the pain. However, it is now recognized that poorly managed pain following trauma or surgery has a negative impact on all major organ systems.¹² Of particular importance for orthopaedic surgeons concerned with infection control is the emerging evidence that postoperative pain suppresses immune defense mechanisms.¹³ Additionally, opioids that are traditionally relied on to manage pain are themselves immunosuppressive.^{14,15}

The understanding that pain is not just a symptom of disease but at times is a disease process in itself is indicative of a fundamental change occurring in the field of medicine. It explains the new emphasis on effective pain control, whether on the battlefield or in the hospital setting.

Chronic Pain

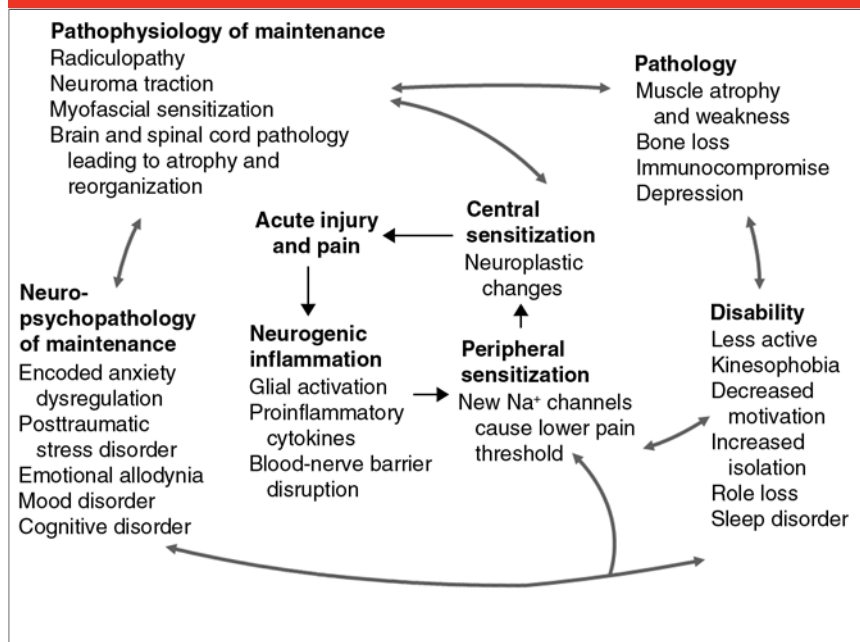
In addition to the negative physiologic consequences of poorly managed pain on the healing process, significant and possibly more devastating biopsychosocial consequences exist for patients who progress from acute to chronic pain conditions. Persons with pain chronification develop a common brain signature in

areas that are known to be involved in processing nociceptive input (ie, pain regulation).¹⁶ This outcome is believed to be reversible with adequate pain management. The pain cycle that leads to chronification begins with an inciting acute traumatic or surgical injury that cascades into a vicious cycle of disability and pathologic changes to the nervous system that continues long after the original tissue damage has healed (Figure 1).

Although posttraumatic stress disorder (PTSD) and traumatic brain injury (TBI) have often been described in the news media as signature injuries of OIF and OEF, the findings of one study indicate that chronic pain is more prevalent than either PTSD or TBI. Lew et al¹⁷ recently examined the medical records of 340 veterans undergoing treatment for polytrauma to determine the incidence of chronic pain, PTSD, and TBI in this population. Chronic pain was noted in 81.5% of these veterans, PTSD was found in 68.2%, and TBI was found in 66.8%, with 41.2% of the cohort experiencing all three conditions simultaneously. Although the Department of Defense (DoD) has invested considerable resources into research and management of PTSD and TBI, pain management has received little attention until recently.

Acknowledgment of the physical reality of the austere air evacuation environment and enhanced understanding that poorly managed acute pain can lead to chronic pain syndromes has motivated the US military to invest significant medical resources in improving battlefield casualty pain management during the past decade. Unique pain technologies used in OIF and OEF at combat support hospitals and on evacuation flights include patient-controlled analgesic pumps, epidural infusion, continuous peripheral nerve block infusion, and ketamine infusions.¹⁸

Figure 1



Chronification: the chronic pain cycle. (Adapted with permission from Gallagher RM: Pharmacologic approaches to pain management, in Ebert M, Kerns R, eds: *Behavioral and Psychopharmacologic Pain Management*. New York, NY, Cambridge University Press, 2011, p 139.)

Table 1

US Army Pain Management Task Force Recommendation Areas¹⁹

- Provide tools and infrastructure that support and encourage practice and research advancements in pain management.
- Build a full spectrum of best practices for the continuum of acute and chronic pain, based on a foundation of best available evidence.
- Focus on the warrior and family. Sustaining the force.
- Synchronize a culture of pain awareness, education, and proactive intervention.

way in which pain management is understood and practiced. Only then can care be optimized for warriors and their families. A cultural adjustment on this scale will be extremely challenging. This movement toward a more holistic, interdisciplinary, multimodal approach to pain medicine will be impossible without improvements in pain education and support from surgical specialists.

US Army Pain Management Task Force

In August 2009, US Army Surgeon General Lieutenant General Eric B. Schoomaker, MD, PhD, chartered the Army Pain Management Task Force (PMTF) to perform a thorough review of pain management practices within the DoD, Veterans' Health Administration (VHA), and major civilian institutions.¹⁹ The task force included representatives from the Air Force, Army, Navy, TRICARE Management Activity, and VHA. Between October 2009 and January 2010, PMTF members conducted 28 site visits to both specialty and primary care environments. Although the PMTF found many areas of "best pain practice" throughout the system, they also found considerable variability between institutions. Spe-

cifically, they noted a lack of clear conformity of pain medicine practice. Often, pain care was driven by local traditions or provider experience and beliefs rather than by evidence-based practices.

Based on their findings, the PMTF published a document that included four broad categories of focus with a total of 109 individual recommendations¹⁹ (Table 1). These recommendations serve as the operational foundation for the PMTF vision statement, which reads, "Providing a standard DoD and VHA vision and approach to pain management to optimize the care for warriors and their families."

Summary

A cultural change in the field of medicine is required with regard to the

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